

The Evaluation of Delayed Treatment on Dentoalveolar Trauma by Surgical Reposition and Wire-Composite Splint Technique

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Abstract

The trauma of dentoalveolar region should consider as an emergency case. A successful management strongly associated with a proper diagnosis and earliest treatment within the limited time. Previous studies suggested that there was an association between a delayed treatment and the pulp-periodontal tissues healing complications such as pulp necrosis, root resorption, and alveolar bone defect.

The purpose of this paper was to evaluate the management of dentoalveolar trauma that treated after 30 hours by surgical reposition and stabilization with the wire-composite splint.

A female patient, 26 years old, came to our Dental Hospital, with chief complaint intrusion and extrusion of three maxillary anterior teeth after fallen to the ground due to loss of consciousness. Based on the clinical and radiographic examination, the diagnosed as dentoalveolar fracture regions 11, 12, 21. Treatment of choice for this case is reposition of the tooth surgically, followed by stabilization using wire-composite splint technique within five weeks. The tooth mobility, tooth sensibility, periodontal tissue's health, and radiographic appearance evaluated up to 3 months. This assessment will continue in six and twelve months after the treatment. Unfortunately, the patient could not return for control since she moved to another city.

We conclude that delayed treatment of dentoalveolar trauma which causes intrusion and extrusion of the teeth can be treated with the reasonable result by surgical reposition, followed by stabilization using the wire-composite splint up to 3-month control

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Introduction

Injury to the dentoalveolar region caused by trauma is quite common and estimated to be 5% of all injuries that makes people seek treatment. Not only in children, dentoalveolar trauma also occurs in adult patients. Approximately 33% of adults have experienced it.¹ The incidence of trauma dentoalveolar caused by falls, playground accidents, abuse and domestic violence, traffic accidents and injuries due to exercise.²

According to the WHO (1978) and

Andreasen (1981), dentoalveolar trauma classification include. Injuries to dental hard tissue and pulp (crown infraction, uncomplicated/complicated crown fracture, uncomplicated/complicated crown-root fracture, and root fracture). Injuries to the periodontal tissues (concussion, subluxation, intrusion, extrusion, lateral luxation, and avulsion). Injuries to the supporting bone (comminution of the alveolar socket, fracture of the alveolar socket wall, fracture of the alveolar process, and fracture of the mandible or maxilla). Injuries to the gingiva and oral mucosa (laceration, contusion, and abrasion).^{2,3}

Intrusion is a severe injury to the periodontal tissue in dentoalveolar trauma. It causes displacement of the tooth deeper into the socket with comminution of alveolar bone around the apical, and can lead to a loss of vascular supply. The incidence of intrusive luxation

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in permanent dentition is very rare, approximately 1.9% - 3% of all cases of trauma in permanent dentition.^{4,5} Whereas, extrusion is a partial displacement of the tooth out of the alveolar socket followed by stretching or rupture of the neurovascular bundle and periodontal ligament.²

Management of dentoalveolar trauma based on IADC (International Association of Dental Traumatology) guidelines (2007) for the intrusion tooth include, spontaneous re-eruption, immediate surgical reposition followed by stabilization, and orthodontic repositioning.⁵ On the other hand, the recommended treatment for the extrusion tooth is repositioning the tooth to its original condition in the socket and followed by stabilization.¹ There are various methods of stabilization includes rigid, semi-rigid and flexible splinting.⁶ In daily practice, we know various techniques such as interdental wiring, acrylic cap splint, Schuchardt splints, Erich arch bars, acid-etch resin splint, wire-composite splint.²

Injuries as results from dentoalveolar trauma can cause post-healing complications such as loss of attachment of the gingiva, marginal bone damage, external root resorption, ankylosis, and pulp necrosis.⁷ The tooth intrusion has a poor prognosis, with the occurrence of complications such as pulp necrosis (96-100%), external root resorption (1-18%), ankylosis and periodontal tissue damage (10%).⁵ Meanwhile, extrusion has lower incidence of post-healing complication rather than intrusion.⁸

Also, the successful treatment of dentoalveolar trauma influenced by several factors. Previous studies have reported an association between treatment variables (delayed treatment, method of repositioning, type of splint, and length of splinting) and post-healing complications.^{9,10}

Pre-injury and injury factors such as age, sex, stage of root development, tooth location, crown-root fracture, severity of displacement, and number of involved teeth also expected to influence the outcome.⁷

Therefore, dentoalveolar trauma, including intrusion and extrusion of the teeth should be considered as an emergency case. Not only for a patient's comfort but to reduce the healing complications, since the successful management requires proper diagnosis and immediate treatment within a limited time.¹⁰ The time interval between the incident and present to

the clinic becomes very critical, because the sooner the injury is treated, the more likely the favourable prognosis as results.² However, considering the frequent occurrence of dentoalveolar trauma, with 2% yearly incidence, it might not always possible to provide emergency treatment on the population level.¹⁰ Thus, it becomes a challenge for clinicians to anticipate these limitations, to achieve optimal results.

The aim of this article is to evaluate the management of dentoalveolar trauma that treated after 30 hours (delayed treatment) by surgical reposition and stabilization using wire-composite splint

Case Report

Twenty-six years old female patient came to the Oral and Maxillofacial Surgery Department of the Universitas Indonesia Dental Hospital. The chief complaints are intrusion and extrusion of three maxillary anterior teeth after she felt due to loss of consciousness since 30 hours before admission to the hospital. History of systemic diseases, neurological disorders and allergies were denied.

Before referred to our department, the patient had come to the other dental office and got temporary filling on the crown of the fractured tooth and wound sutured of mucosal lower lip laceration.



Figure 1. Pre-operative clinical condition, teeth 11 and 21 intrusions with uncomplicated crown fracture, and tooth 12 extrusions and displaced palatally.



Figure 2. Pre-operative dental radiograph revealed that teeth 11 and 21 intrusions, and tooth 12 extrusion.

had 2 mm intrusion, whereas tooth 12 had extrusion about 5 mm (Figure 2). All the teeth had a perfect root formation, there was a widening of periodontal space around the apical, and there was no fracture line of the root and surrounding alveolar bone.



Figure 4. Clinical appearance of the teeth after crown restoration.



Figure 3. Clinical appearance of the teeth after surgical reposition.



Figure 5. Clinical appearance of the teeth after stabilization using wire-composite splint technique.

On extra-oral examination, there was an excoriated lower lip. Intra-oral examination showed mucosal laceration of lower lip with intact sutured, tooth 11 and 21 intrusions with uncomplicated crown fracture, while tooth 12 extrusion and displaced to the palatal (Figure 1). All the teeth were still showing a positive response to a cold test; there was no tooth mobility, no step or discontinuity of maxillary alveolar bone, and a little tenderness to percussion. Radiographic examination revealed that tooth 11 had 4 mm intrusion and tooth 21

Based on clinical examination and radiographic findings, we diagnose as dentoalveolar fracture regions 11, 12, 21. The treatment of choice for this patient are surgical reposition followed by fixation the teeth using 0.3 mm wire and light cured composite resin/wire-composite splint (Figure 2, 3, 4). Patients were prescribed antibiotic, analgesic and mouthwash antiseptic. Patient also instructed to consume soft diet for 2 weeks, maintain good oral hygiene and avoid direct trauma due to suppression of mastication force and another habit.



Figure 6. Clinical appearance of the tooth before splint was removed.



Figure 7. Clinical appearance of the teeth after five weeks.



Figure 8. Orthopantomograph appearance after five weeks.

The patient was evaluated periodically in the 1st, 2nd, 5th and 12th week. We observed the presence of infection signs (fistulas, swelling), pulp sensibility, tooth discoloration, tooth mobility, gingival-periodontal health and radiographic appearance (Table 1).

Clinical Appearance	Week I	Week II	Week V	Week XII
Signs of Infection	No	No	No	No
Pulp Sensibility	Positive	Positive	Positive	Positive
Tooth Discoloration	No	No	No	No
Tooth Mobility	NP	NP	1 – 2 °	1 – 2 °
Gingival Probing	NP	2 – 3 mm	2 – 3 mm	2 mm
Percussion Test	Tenderness	No tenderness	No tenderness	No tenderness
Radiographic Findings				
Root Resorption	NP	NP	No	No
Apical Radiolucency	NP	NP	No	No
Integrity of Lamina Dura	NP	NP	Intact	Intact

Table 1: The periodical evaluation of treatment results. NP: *Not Performed*.



Figure 9. Clinical appearance of the teeth after three months.



Figure 10. Dental radiographic appearance after three months.



Figure 11. Othopantomograph appearance after three months.

The patient had increased tooth sensitivity when exposing to cold air and water during first week but gradually returned to normal after second week onward. After five weeks, the splint was removed, and the patient was going on observation for 3 months (Figure 5, 6, 10). The evaluation give good result, there were an improvement on healing in dental and periodontal ligament from week to week (Figure 7, 9, 11). Table 1 shows a summary of the evaluation processes. The evaluation will be regularly continued during six months, 12 months and a few years later, to ensure the development and progress of treatment results.

Discussion

Trauma dentoalveolar which cause luxation of the tooth, such as intrusion and extrusion, often occurs in both primary and permanent teeth in the region of the maxillary central incisor.² To establish the diagnosis, it relies entirely on a history of trauma, clinical and radiographic examinations.³ The prognosis of intrusion worse than extrusion as it often cause complications after healing.⁵ However, it has been reported that the intrusion tooth can return to normal function, and pulp-periodontal healing occurs.⁴

Treatment for intrusion teeth as recommended by some authors are reposition either by orthodontic treatment or surgical procedure.^{5,8,9} For those who recommend orthodontic treatment for the reason that it allows remodeling of bone and periodontal tissues, whereas the surgical reposition method can increase root resorption, sequester formation and loss of marginal bone support.^{5,9,11} However,

Ebeleseder et al. (2000) state that surgical reposition can easily restore the teeth and adjacent tissues to the original anatomical position in the socket to allow repair immediately.¹¹ It also causes removal of bacterial contamination from the crown surface and released compression on peri-radicular areas that can reduce the activity of osteoclasts.⁹ Studies by Kinirons (1991), Sutcliff (1991) and Ebeleseder et al. (2000), reported that surgical reposition did not lead to an increase root resorption and possible damage to the periodontium. That can be minimized by the skill of the operator skill.¹² In this present case, we choose surgical reposition as treatment of choice considering patient age, the severity of intrusion, and urgently need of the patient to repair her aesthetic and mastication function.

Management of extrusion tooth based on IADT (2007) are repositioned tooth immediately on the first visit and stabilize tooth using the flexible splint. If it can not be done due to a blockade of blood clot or as a result of a delayed treatment, an intentional replantation can be choose.¹³ We choose to reposition the tooth in this present case, in order to provide the possibility of periodontal ligament reattachment and pulp revascularization.

Tooth stabilization, for long decades, was based on the principles of immobilization for jawbone and alveolar process fractures. However, since the development of a composite resin with the acid-etching system on the enamel, the treatment principles have changed.¹⁴ In this present case, after the repositioning, all the teeth stabilized by semi-rigid splinting using 0.3 mm wire and composite resin light cured. The choice of this technique based on the theory that splinting should be able to provide adequate fixation, and provide space for the tooth to move physiologically.¹⁴ It aims to accelerate the healing process of periodontal tissues by giving the attachment apparatus of the ligament to regenerate.² Also, the wire-composite splint also meet the requirements of modern tooth splint, such as splints that can be made quickly outside the laboratory using conventional dental materials. Easy to apply, inexpensive, easy to remove without causing damage to the teeth and supporting tissue, and not interfere with occlusion and dental hygiene.¹⁴ Erich arch bars and interdental wiring technique no longer recommended for tooth stabilization after luxation.

Because it can cause mechanical irritation of the gingival margin and cementum surface of the tooth, become a site for bacterial deposition, technically difficult in applying and cleaning up.²

The five weeks splinting duration gave good results namely physiological tooth mobility. Although there were reports that the length of splinting could affect the healing process.¹⁴ However, Andreasen et al. (2006) concluded that there was no significant difference between the length of splinting with treatment outcome.⁹ We determined length of splinting according to Diangelis et al. (2012) that recommend stabilizing the teeth for 4-8 weeks after repositioning.¹⁵

Delay treatment was present as the special conditions of this case. Delay in getting treatment for more than 24 hours defined as delayed treatment.¹⁵ Pulp necrosis and root resorption, are often found in patients with delayed treatment after experienced dentoalveolar trauma. It is because the compression of the root against alveolar bone and delay in repositioning may increase the incidence of these complications.^{5,10} In another study, in which luxation injuries with a displacement of the tooth analyzed as one group, there was significant difference between teeth treated within 33 hours after injury with those treated later.¹⁰ However, Andreasen et al. (2006) in a study on 140 teeth, state 1-day delayed treatment is not a significant factor for occurrence post-healing complications, which means tooth luxation did not require immediate treatment.⁹ Apparently, the definite relationship between delayed treatments with an occurrence of complications is yet uncertain. But to deal with clinical symptoms such as malocclusion and mastication disturbance, immediate treatment is indicated in both cases of intrusion and extrusion.¹⁰

Assessment of pulp vitality is an important diagnostic procedure in the treatment of dentoalveolar trauma. The vitality of the pulp absolutely depends on their viable blood supply, although it is still fairly reliable assuming pulp respond to stimuli (sensibility test) as a pulp vitality indicator.^{16,17} In this present case, we choose cold test (ethyl chloride) to predict vitality of the pulp. Even though there is a low accuracy of the sensibility test if performed soon after the trauma.¹⁸ However, a cold test can return to normal results within three months after the trauma.¹⁷ All the injured teeth give a positive

response to cold test since day-2 after the incident until three months follow-up. The initial positive response is a good predictor because there is a high possibility that the pulp remain vital.¹⁸ According to Peters et al. (1994), it is much rare to obtain a false positive response to cold test than electric pulp test (EPT). Because the ability to cause a response through damaged tissue is lost much sooner for the cold test than EPT.¹⁷ Research by Evans et al. (1999) also reported that there was no significant difference in sensitivity between the Laser Doppler Flowmetry (LDF) which is the golden standard of pulp vitality test with cold test.¹⁶

Assuming the pulp remains vital after trauma, we postponed endodontic therapy, even though the prophylactic extirpation of the pulp has been recommended immediately to prevent complications.⁵ According to Bashkar and Rappaport (1973), after observing the serial cases of 25 traumatized teeth. They recommended endodontic therapy should be delayed, and the affected pulp tissue is should be considered in vital condition unless peri-apical radiolucency develop.¹⁷ Moreover, there are additional signs that can be used to assess pulp necrosis include discoloration of the crown, the presence of fistula, and the presences of radiographic signs (peri-apical radiolucency, root resorption).¹⁸ For that reason, a longer observation is needed to determine the accuracy of this pulp vitality status.

Evaluation of gingival and periodontal tissues health showed improvement. It characterized by normal color and texture of the gingiva, there was no tenderness to percussion, and the depth of the gingival sulcus in all teeth within normal limits. Several indicators of pathological states in gingival and periodontal tissues are tenderness to percussion and value > 3 mm when probing.^{2,19} Radiographic evaluation up to 3 months also showed there was no peri-apical radiolucency. There was no thickening or widening of the periodontal ligament, and the absence of root resorption, which of this condition give positive signs to healing progress.¹⁹ In the previous study, root resorption reported to occurs in 5 to 15% cases of luxation injury within the first 2 – 5 months.¹² Al-Badri et al. (2002) reported complete root formation tooth have higher tendency to undergo root resorption, and it can occur up to about ten months after injury.²⁰ Therefore, these current conditions are

not yet insisting the successful of the treatment, and long-term follow-up still required.

The presence of pre-injury and injury factors could handle the forthcoming complications. In this present case, the root development was expected as a significant factor determining the healing outcome. Due to the width of apical foramen associated with the chance of revascularization, and more mineralized tooth can cause greater damage to the periodontal tissues.⁷ Then, fracture involves the enamel and dentin without exposing the pulp (uncomplicated crown fracture), also have an effect in causing pulp necrosis due to the bacterial invasion of ischemic pulp through dentinal tubules.^{7,15,19} However, the most critical determinant of pulp and periodontal survival according to Kenny et al. (2003) is the severity of the injury.⁵ The most severe the injury, the more likely impact on the greater tendency towards post-healing complications.⁷

Occasionally, even several standard treatment procedures such as dentin coverage, repositioning, splinting, and antibiotics had performed, the result sometimes was still unfavorable. It is because the treatment guidelines for dentoalveolar trauma are still not evidence-based, besides randomized controlled trials not available since its unethical issue in an emergency.^{4,21} Thus, the analysis and final evaluation of the long-term treatment effect and its relation to healing is not possible to achieve. Therefore, the essential purpose of the definitive treatment today is to normalize occlusion, aesthetics, restore speech and masticatory function.²¹

Conclusions

Delayed treatment of dentoalveolar trauma that cause intrusion and extrusion of the tooth can be treat with reasonable result by surgical reposition followed by stabilization using the wire-composite splint. This procedure recommended as a treatment of choice that are adequate, simple, aesthetic, and can reduce the possibility of post-healing complication.

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Declaration of Interest

The authors report no conflict of interest.

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